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EFFECT OF URBAN COMPOST, SEWAGE SLUDGE AND POULTRY MANURE WITH CHEMICAL FERTILIZERS ON YIELD AND PROFITABILTY IN BRINJAL-CAULIFLOWER SYSTEM

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ABSTRACT

An experiment was conducted during kharif 2013 and rabi 2013-14 at College of Agriculture, College farm, Rajendranagar, Hyderabad to evaluate the best combination of organic and inorganic sources of nutrients for maximizing yield and profitability. Combined application of poultry manure 5 t ha^{-1} + 75% recommended dose of NPK recorded higher fruit yield (33.6 t ha^{-1}) and curd yield (29.3 t ha^{-1}) followed by combining application of sewage sludge 5 t ha^{-1} + 75% recommended dose of NPK. The highest benefit: cost ratio obtained in treatment with sewage sludge 5.0 t ha^{-1} + 75 per cent RDF for brinjal (2.14) and cumulative sewage sludge applied 5.0 t ha^{-1} + 75 per cent RDF for cauliflower crop (2.40). Pooled data of economic analysis indicated that the highest B: C ratio (2.27) was obtained with sewage sludge 5.0 t ha^{-1} + 75 % RDF.

KEYWORDS: Sewage Sludge, Urban Compost, Poultry Manure, Fertilizers, Yield & Benefit Cost Ratio

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Original Article

INTRODUCTION

Presently, India presently supports 17% of the world population with only 4.0% world's water resources and 2.4% global geographic area (State of Indian Agriculture, 2012-13). This may further decrease in the future due to increasing demographic pressure and consequent diversion of land for non agricultural use. To meet the need of blooming population, we are forced to exploit the land beyond its capability. It leads to degradation of soil resources through erosion, nutrient mining, soil organic carbon depletion, salinization, and decrease in soil structure. Since land is a finite natural resource, we cannot increase the area under cultivation to get higher production. So, the only solution is to increase the yield per unit area in a sustainable way. The imbalanced and skewed application of NPK accompanied by restricted use of organic manures and micronutrients has made soils not only deficient in the nutrients, but also deteriorated the soil health, resulting in declining of the crop response to the application of fertilizers. On the other hand, Organic manures alone may not be able to meet the nutrient requirement of high yielding crops to produce the required food grains for the burgeoning human population, due to their low nutrient contents and slow rates of nutrient release. Under this circumstance, integration of chemical and organic sources and their management have shown promising results not only in sustaining the productivity, but have also proved to be effective in maintaining soil health and enhancing nutrient use efficiency (Laxminarayana *et al.*, 2011; Kumar Mukesh *et al*., 2012). The supplementary and complementary use of organic manures and inorganic fertilizers augment the efficiency of both substances to sustain soil productivity.

Integrated Nutrient Management (INM) system envisages the use of inorganic fertilizers and organic manures, besides taking into account the fertility status of the soils. Integrated use of organic manures and

chemical fertilizers generally produces higher crop yields than their sole application. This increase in crop productivity may be due to the combined effect of nutrient supply, synergism and improvement in soil physical and biological properties (Sarawad *et al.*, 2005). Brinjal is one of the most commonly grown vegetable crops of the country. India produces about 12,916 MT of brinjal from an area of 709M ha with an average productivity of 18.21 t/ha. The brinjal producing states are Orissa, Bihar, Karnataka, West Bengal, Andhra Pradesh, Maharashtra and Uttar Pradesh (Indian Horticultural Data Base, 2012-13). Cauliflower is one of the most important winter vegetables of India. India produces 7765 MT of cauliflower per year from 409 M ha areas with an average productivity of about 18.98 t/ha (Indian Horticultural Data Base, 2012-13). Keeping in view the significance of organic manures in maintaining the soil health, the importance of brinjal and cauliflower in human nutrition, an attempt was made to critically examine the use of poultry manure, sewage sludge and urban compost along with chemical fertilizers to obtain better yields, and to maintain better soil health in brinjal-cauliflower cropping system under integrated nutrient management.

MATERIALS AND METHODS

A field experiment was conducted at College farm, Rajendranagar, during *kharif* 2013 and *rabi* 2013-14. The soil was sandy loam in texture and slightly alkaline in reaction. It was low in available N, medium in available P, K and low in organic carbon. The experiment was laid out in a randomized block design with 14 treatment combinations, each being replicated thrice consisting of two levels of each of sewage sludge, urban compost and poultry manure 2.5, 5.0 t ha^{-1} and combination of 75 percent RDF. The organic manures i.e., poultry manure (PM), urban compost (UC) and sewage sludge (SS) procured from poultry station, Rajendranagar, Hyderabad, SELICO private company gandemguda, Rangareddy and Amberpet sewage treatment plant, respectively. All theses manures were analyzed for their chemical composition viz., N, P, K, and OC, pH, EC and available micronutrients. All these manure were applied as per the treatments. N, P and K were applied through Urea, SSP and MOP, respectively, while the total quantity of phosphorus and potassium were applied as basal and nitrogen was applied in three equal splits viz. 1/3 as basal, 1/3 at flowering and the remaining 1/3 at fruit formation to brinjal. Thirty days old seedlings of brinjal (hybrid) were transplanted on ridges at a spacing of 60 cm x 60 cm. During *Rabi* season, cauliflower was grown to know the manures and fertilizers effect on soil to assay the cumulative and residual effects on cauliflower from the earlier brinjal crop. Each earlier treatments plot was divided into two; among them, one plot was used to get a cumulative effect on cauliflower, other one was used to get the residual effect on cauliflower. However, the crop was grown without the addition of any manure and fertilizer for residual sub plot. The cumulative sub plot was applied with fertilizers and manures as per the crop recommendation and treatments. Gross returns, net returns and benefit cost ratio were calculated for each treatment by considering prevailing input costs and output prices.

Gross returns = Fruit yield x Price of fruit

Net returns = Gross returns – Cost of cultivation

Benefit: Cost ratio	=	Net returns (Rs. ha^{-1})
		Cost of cultivation (Rs. ha^{-1})

RESULTS AND DISCUSSIONS

Brinjal Fresh Fruit Yield *(Kharif*, 2013)

The fruit yield of brinjal was significantly influenced by different levels of organic manures and inorganic fertilizers. The lowest and highest yields were recorded at T_1 (control) and T_{14} (PM @ 5 t ha^{-1} +75% RDF), respectively. The fruit yield varied from 16.0 to 33.6 t ha^{-1}. However, the yield recorded at T_{14} was on par with that recorded at T_{12} (32.5 t ha^{-1}), T_{10} (29.0 t ha^{-1}) and T_{13} (30.0 t ha^{-1}) and significantly superior over all other treatments. Conjunctive use of different levels of chemical fertilizers with any one of the organics produced higher yields as compared to their individual applications. This was due to the direct availability of nutrients from inorganic fertilizers, and also the manures containing higher available N, P and K contents. The maximum yield in treatment T_{14} was due to more number and large sized fruits as well as increased the synthesis of carbohydrates, which ultimately promoted greater yield. The above results corroborate with Rakhonde *et al.* (2005).

Cauliflower Fresh Head Yield *(Rabi,* 2013-14)

In the second season of cumulative and residual effect on *rabi* 2014, cauliflower significantly increased yield of 29.3 t ha^{-1} and 22.0 t ha^{-1} was recorded in T_{14} (PM @ 5 t ha^{-1} +75% RDF), followed by T_{12} (SS @ 5 t ha^{-1} +75% RDF) 28.7 t ha^{-1} and 21.8 t ha^{-1}. Integrated manures and fertilizer applied plots showed good response to yield, and individually manure treated plots showed a significantly lesser yield than combined applications. The relative increase in yield by combining application of poultry manure and fertilizers could be attributed to improvement in soil structure, nutrient retention and water for plant use. Combined application of organic and inorganic fertilizers helps in growing cauliflower by effectively utilizing the left over nutrients after harvest of brinjal. The combined application of NPK fertilizers and poultry manure had shown to more effective. These results are in accordance with those of Isitekhale and Osemwota, 2010.

Economics of Brinjal Cultivation

Among the different treatments, highest yield of 33.6 t ha^{-1} were recorded with T_{14} (PM @ 5.0 tha^{-1}+75% RDF) followed by T_{12} (SS @ 5.0 t ha^{-1}+ 75% RDF), 32.5 t ha^{-1}. Considering the cost of organic manure and inorganic fertilizers, the net returns obtained from T_{14} was found to be Rs.1, 36,979 ha^{-1} followed by T_{12} (Rs.1, 32,954). Considering the total cost of cultivation and net returns, the B: C ratio was highest in treatment T_{12} (SS @ 5.0 tha^{-1}+75% RDF), *i.e.,* 2.14, followed by T_{14} (2.11) and T_{13} (1.85). Sewage sludge showed higher B: C ratio when compared with poultry manure treatments even though high gross returns were obtained with use of poultry manure. This may be attributed to higher cost of poultry manure (Rs. 600 per tonne) as compared to sewage sludge (Rs. 85 per tonne). Among individual manure treatments, sewage sludge, poultry manure and urban compost treatments showed higher B: C ratios than control. Sewage sludge, poultry manure and urban compost applied @ 2.5 t ha^{-1} and at @ 5.0 t ha^{-1} showed lower B: C ratios than with 100 percent RDF (1.60).

Economics of Cumulative Cauliflower Cultivation

Application of PM @ 5.0 t ha^{-1}+75% RDF gave the highest 29.3 t ha^{-1} of cauliflower yield followed by T_{12} (SS @ 5.0 tha^{-1}+75% RDF) with the recorded yield of 28.6 t ha^{-1}. Lowest yield of 13.0 t ha^{-1} was recorded from control treatment. Higher net returns were given by T_{14} (PM @5.0 t ha^{-1}+75% RDF), Rs. 1, 64,390 followed by T_{12}, Rs. 1,61,845, whereas, significantly lower net returns were noticed with control treatment (Rs. 39,175). B: C ratio was significantly higher in T_{12} *i.e.,* 2.40, followed by T_{14} (2.34) and T_{11} (2.22), respectively. All the manures without conjunctive application of fertilizers

showed higher B: C ratio than control, but those values were lower than full dose of recommended fertilizers. All combined treatments recorded higher B: C ratio than treatment with full dose of recommended fertilizers.

Economics of Residual Cauliflower Cultivation

Among the different residual treatment combinations, highest yield (22.0 t ha^{-1}) was recorded with PM @ 5.0 t ha^{-1}+75% RDF followed by SS @ 5.0 t ha^{-1}+75% RDF) (21.8 t ha^{-1}). Without considering the application of manures and fertilizers, higher net returns were obtained from T_{14} which was found to be Rs. 1, 11,175 per hectare followed by T_{12} (Rs. 1, 09,575) and T_{13} (Rs. 88, 775), but considering the total cost of cultivation and net returns, the B: C ratio was highest in treatment T_{14} (PM @ 5.0 tha^{-1}+75% RDF) *i.e.*, 1.71, followed by T_{12} (1.69).

Economics of Brinjal– Cauliflower Cropping Sequences

Pooled data on economic analysis, the highest B: C ratio was obtained with SS @ 5.0 t ha^{-1} + 75% RDF (2.27) closely followed by PM @ 5.0 t ha^{-1} + 75% RDF (2.23). The lowest B: C ratio was obtained in control (0.60).

Economics of Cauliflower (Regular + Residual) Cultivation

The highest B: C ratio was found in SS @ 5.0 t ha^{-1} + 75% RDF (2.05) closely followed by PM @ 5.0 t ha^{-1} + 75% RDF (2.04). The lowest B: C ratio was obtained in control (0.38).

During the brinjal and cauliflower cultivation, highest yield and net returns were obtained from integrated treatments. Manures treatments like sewage sludge, poultry manure and urban compost had good net return and B: C ratio but it was lesser compared to combined treatments. On an overall view, integrated treatments performance was better than manures alone. Similarly, Hochmuth *et al.* (1993) conducted field experiments on cabbage and showed that, marketable yield increased through poultry manure and RDF application. Combined application of organic and inorganic sources of nutrients can be more productive, and this will also sustain the fertility and productivity of soil.

CONCLUSIONS

It can be concluded that the highest B: C ratio (2.27) was obtained with sewage sludge @ 5.0 t ha^{-1} along with 75 per cent RDF to both the crops. To obtain higher income, application of sewage sludge @ 5.0 t ha^{-1} along with 75 per cent RDF for brinjal – cauliflower cropping sequence is recommended. This helps in disposal of the sewage sludge and increasing the returns from crops without any harmful effects on produce.

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